Name: Date: Class:

Hurricanes as Heat Engines Story Map Student Sheet

Link to Story Map: https://arcg.is/1n1T8v

Part A: Engage

A.1. What differences do you observe between the image of the Southeastern United States on Sept. 13th and the image on Sept. 14th?

A.2. What patterns do you see in the sea surface temperature data?

A.3 Make a claim about the relationship between hurricanes and sea surface temperature.

Note: Remember this claim as you will refer to it later on in this lesson.

Part B: Explore

B.1 What colors do you see?

B.2 What do the colors mean?

B.3 Where are the highest values? The lowest?

B.4 Using the simulation from the previous slide, fill in the chart with the sea surface temperature required to form each category hurricane.

Hurricane	Satellite Image	Category Wind Speed	Sea Surface Temperature
Hurricane Isaac September 10, 2018		**Category 1** Winds 119-153 km/hr (74-95 mph)	
Hurricane Helene September 10, 2018		**Category 2** Winds 154-177 km/hr (96-110 mph)	
Hurricane Ophelia October 14, 2017		**Category 3** Winds 178-209 km/hr (111-130 mph)	
Hurricane Florence September 10, 2018		**Category 4** Winds 210-249 km/hr (131-155 mph)	
Hurricane Matthew October 1, 2016		**Category 5** Winds greater than 249 km/hr (155 mph)	

B.5 What is the minimum sea surface temperature required for a hurricane to form?

B.6 How does this activity support the claim you made about the relationship between hurricane formation and sea surface temperature?

B.7 What do you see? Identify any trends or differences you see in the graph.

B.8 What do these trends or differences mean?

B.9 Write a complete paragraph caption for this graph. Start with a topic sentence that describes the whole graph. In the body of the paragraph include the trends and differences you saw and their meanings from questions B.7 and B.8.

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B.10 What is something you would like to know about this graph? Come up with a research question you could ask.

B.11 How does this support your claim about the relationship between hurricanes and sea surface temperature?

B.12 Where in the world do you find the highest values of data in the image?

B.13 Do you notice any patterns in the data?

B.14 How does this relate to the claim you made about the relationship between sea surface temperature and hurricanes? What evidence do you have to support your reasoning?
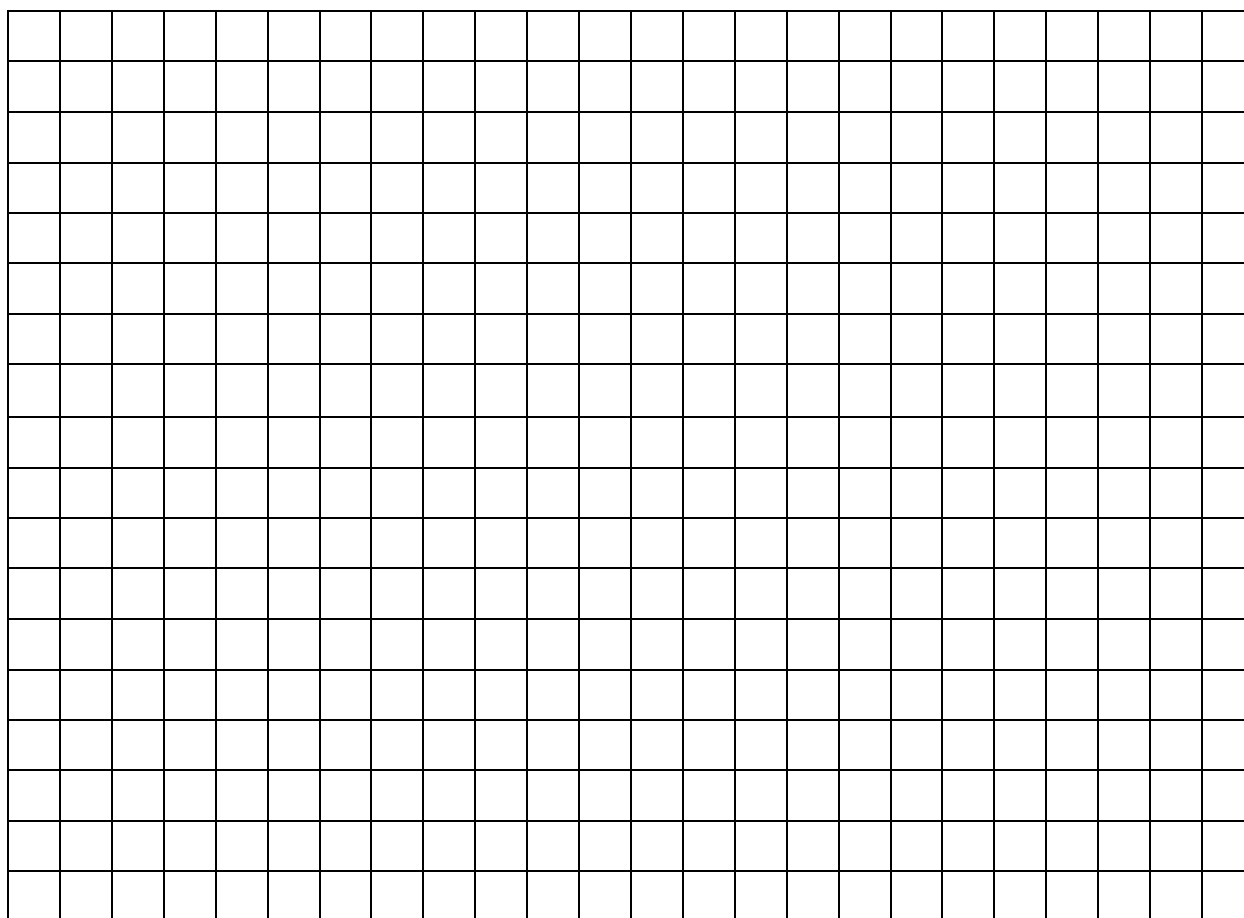
B.15 Using the map, determine tropical cyclone count at the coordinates listed below.
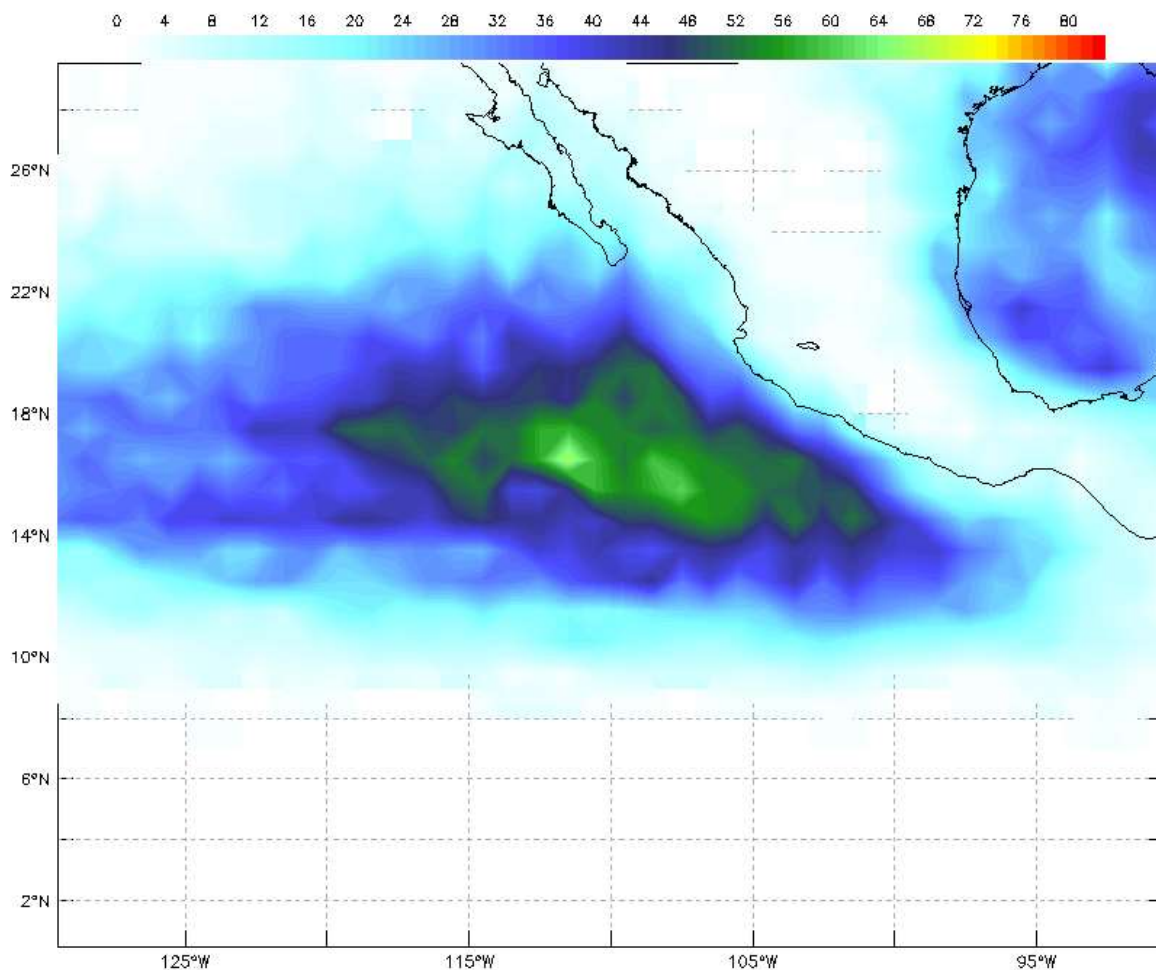
Latitude	Longitude	Tropical Cyclone Count
9°N	108°W	
13°N	108°W	
17°N	108°W	
21°N	108°W	
25°N	108°W	

B.16 Plot your tropical cyclone counts against their respective latitudes using the graph paper provided in the student worksheet.

B.17 Describe what your line plot represents.

B.18 At what latitudes are tropical cyclones most likely to occur in this part of the world?

B.19 Predict the relationship between sea surface temperature and the distribution of tropical cyclones in the image. Use evidence from earlier activities to support your prediction.

B.20 In which season does your simulated hurricane get the strongest?

B.21 What differences in sea surface temperature do you notice between the seasons?

B.22 Where do you find the greatest color (temperature) difference between seasons?

B.23 Which season has the warmest sea surface temperatures? What about the coldest?

B.24 What factors strengthen hurricanes?

B.25 What factors weaken hurricanes?

B.26 Using what you have learned about hurricanes as heat engines, write a paragraph explaining why hurricanes occur in this particular season. Use evidence from previous parts of this lesson to support your claim.

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B.27 Why does Hurricane Florence strengthen as it approaches North America?

B.28 How does the strengthening of Hurricane Florence along its path support your claim?

Part C: Explain

C.1 What effect do oceans have on hurricanes?

C.2 What effect do hurricanes have on oceans?

C.3 Which becomes warmer during a sunny day, land or water? Which is slower to warm, but also slower to cool?

C.4 What is the difference between a typhoon and a hurricane?

C.5 If the storm surge of a hurricane is 7ft., what category hurricane is this?

C.6 At what hurricane speed can windows break?

Part D: Elaborate

D.1 What difference do you notice between the two images? What do you think is the reason for this difference? (Hint: Think back to the Explain tab, where you learned what happens to the ocean as a hurricane passes over.)

D.2 Based on what you have learned, and using your plot, what date did the hurricane pass? What evidence do you have to support your answer?

Part E: Evaluate

E.1 Observe the sea surface temperature surrounding the tropical depression and its path. Will this new tropical depression strengthen or weaken? What evidence do you have to support your claim? Incorporate reasoning from what you've learned about the science of hurricane formation.

E.2 Observe the sea surface temperature surrounding the hurricane and its path. Will this hurricane strengthen or weaken? What evidence do you have to support your claim? Incorporate reasoning from what you have learned about the science of hurricane formation.

E.3 What do you observe? What happened to the hurricane?

E.4 Based on what you've learned about hurricane formation, what do you think happened to this hurricane during July 3rd – 7th? Use evidence and reasoning to support your conclusion.